Reg. No.												

SAI RAM INSTITUTE OF TECHNOLOGY

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CONTINUOUS ASSESSMENT TEST - II

Question Paper Code	24NU12F062

Course Code - Name : 24BSMA101 – Matrices and Calculus

Degree & Program : B.E / B.Tech ALL BRANCHES (Except CSBS)

Date of Exam : 02.12.2024 Year / Semester : I / I

Duration : 1 ½ Hours Max. Marks : 50

Answer ALL Questions

PART – A (10× 1 = 10 Marks)

		K-Level	CO
1	Which of the following is $\nabla\phi$ if $\phi = xyz$? a) $yz\vec{i} + xz\vec{j} + xy\vec{k}$ b) $y\vec{i} + x\vec{j} + x\vec{k}$ c) $z\vec{i} + z\vec{j} + y\vec{k}$ d) $\vec{i} + \vec{j} + \vec{k}$	K2	CO3
2	The divergence of the vector field $3xz\vec{i} + 2xy\vec{j} - yz^2\vec{k}$ at a point (1,1,1) is equal to a) 7 b) 4 c) 3 d) 0	K2	CO3
3	A vector field with a vanishing curl is called as _____ a) Irrotational b) Solenoidal c) Rotational d) Cycloidal	K1	CO3
4	Curl of $\vec{F}(x,y,z) = 2xy\vec{i} + (x^2 + z^2)\vec{j} + 2yz\vec{k}$ is _____ a) $xy^2\vec{i} - 2xyz\vec{k}$ and irrotational b) 0 and irrotational c) $xy^2\vec{i} - 2xyz\vec{k}$ and rotational d) 0 and rotational	K2	CO3
5	Curl Curl $\vec{F}$ = a) grad div $\vec{F}$ - $\nabla^2\vec{F}$ b) grad div $\vec{F}$ + $\nabla^2\vec{F}$ c) div $\vec{F}$ - $\nabla^2\vec{F}$ d) div $\vec{F}$ + $\nabla^2\vec{F}$	K1	CO3
6	If $\vec{F} = x^2\vec{i} + xy^2\vec{j}$, then $\int_C \vec{F}.\vec{dr}$ from (0,0) to (1,1) along the path $y = x$ is (a) $\frac{12}{7}$ (b) $\frac{7}{12}$ (c) $\frac{-12}{7}$ (d) $\frac{-7}{12}$	K2	CO4
7	The area of the region enclosed by a simple closed curve C will be (a) $\frac{1}{2}\int_C \frac{1}{x}dy - \frac{1}{y}dx$ (b) $\frac{1}{2}\int_C xdy - ydx$ (c) $\frac{1}{2}\int_C xdy - ydx$ (d) $\frac{1}{2}\int_C \frac{1}{x}dy + \frac{1}{y}dx$	K1	CO4
8	The Gauss divergence theorem gives (a) relation between surface integral and volume integral (b) relation between line integral and volume integral (c) relation between line integral and surface integral	K1	CO4

(d) none of the above

9	Let S be a closed surface, then $\iint_S curl\,\vec{F}.\hat{n}\,dS =$	K2	CO4
	(a) -1 (b) 1 (c) 2 (d) 0		
10	Which of the following is obtained by evaluating $\iint_S \vec{F}.\hat{n}\,dS$ where S is closed surface and V is the volume using Gauss divergence theorem if $\vec{F} = (ax)\vec{\imath} + (by)\vec{\jmath} + (cz)\vec{k}$?	K3	CO4
	(a) $\frac{4\pi}{3}$(a+b+c) (b) $\frac{4\pi}{5}$(a+b+c) (c) $\frac{2\pi}{3}$(a+b+c) (d) $\frac{\pi}{3}$(a+b+c)		

PART – B (10 × 2 = 20 Marks)

		K-Level	CO
11	Find the directional derivative of $\phi = x^2yz + 4xz^2$ at the point $(1, -2, -1)$ in the direction of $2\vec{\imath} - \vec{\jmath} - 2\vec{k}$.	K3	CO3
12	Prove that $div\,\vec{r} = 3$ and $curl\,\vec{r} = \vec{0}$.	K2	CO3
13	Find a such that $\vec{F} = (3x - 2y + z)\vec{\imath} + (4x + ay - z)\vec{\jmath} + (x - y + 2z)\vec{k}$ is solenoidal.	K2	CO3
14	Prove that $\vec{F} = yz\,\vec{\imath} + zx\,\vec{\jmath} + xy\,\vec{k}$ is irrotational.	K2	CO3
15	If $\vec{A}$ and $\vec{B}$ are irrotational, then prove that $\vec{A} \times \vec{B}$ is solenoidal.	K2	CO3
16	Find the work done, when a force $\vec{F} = (x^2 - y^2 + x)\vec{\imath} - (2x + y)\vec{\jmath}$ moves a particle from the origin to the point (1,1) along $y^2 = x$.	K3	CO4
17	Using Green's theorem in the plane, find the area of the circle $x^2 + y^2 = a^2$.	K3	CO4
18	State Stoke's theorem.	K1	CO4
19	Using Stoke's theorem prove that $curl(grad\phi) = 0$.	K3	CO4
20	Evaluate $\iint_S (xdydz + ydzdx + zdxdy)$, where S is the surface of the sphere of radius a.	K3	CO4

PART – C (2 × 10 = 20 Marks)

			Mark Split up	K-Level	CO
21.	a)	Find a and b so that the surfaces $ax^2 - byz = (a + 2)x$ and $4x^2y + z^3 = 4$ cut orthogonally at the point $(1, -1, 2)$.	10	K3	CO3
		(Or)			
	b)	Show that $\vec{F} = (6xy + z^3)\vec{\imath} + (3x^2 - z)\vec{\jmath} + (3xz^2 - y)\vec{k}$ is irrotational vector and find the scalar potential ϕ such that $\vec{F} = \nabla\phi$	10	K3	CO3
22.	a)	Verify Green's theorem in a plane for $\int_C [3x^2 - 8y^2)dx + (4y - 6xy)dy]$, where C is the boundary of the region defined by the lines $x = 0$, $y = 0$ and $x + y = 1$.	10	K3	CO4

(Or)

b) [illegible] 20 K3 CO4

Course Outcomes

CO1	[illegible] the vector integral theorems and apply Cayley Hamilton Theorem to find the inverse and integral powers of a square matrix. (K3)
CO2	Evaluate the line, surface and volume integrals and use them to relate the functions of several variables. (K3)
CO3	Compute the derivatives of scalar and vector point functions. (K3)
CO4	Use the vector point functions to analyze the relations between line, surface and volume integrals. (K3)
CO5	Apply matrix and vector integration techniques to evaluate the volume of a region. (K3)
CO6	Compute Fourier series expansions of functions. (K3)

Distribution of COs (Percentage wise)

CO1	CO2	CO3	CO4	CO5	CO6
[illegible]	—	—	[illegible]	[illegible]	—